Appendix C.5. Native Grasslands and Native Shrub Habitats

Native grasslands and native shrub habitats are important to protect from new development because many of the wildlife species associated with these habitats occupy large territorial ranges, are vulnerable to human disturbances, and disappear from the landscape if habitat patches become too small or fragmented. In fact, approximately 21 percent of the mammals, birds, reptiles, and amphibians associated with these two habitat types are considered Species of Concern in the State of Montana (MT Field Guide 2012). In addition, these habitats are difficult—if not impossible—to restore once native vegetation has been removed.

Habitat Descriptions and Locations

Because of the distinctions between native grasslands and native shrub habitats, they are described separately in this section:

Native Grasslands

Native grasslands include native prairie grasslands in eastern Montana and intermountain/foothill grasslands in western Montana.

Prairie Grasslands

Prairie grasslands are the native grasslands found in the eastern two-thirds of Montana. This habitat is also referred to as mixed-grass prairie (MT Field Guide 2012) and/or plains grasslands (Montana's Comprehensive Fish and Wildlife Conservation Strategy (MCFWCS) 2005).

Prairie Grasslands Description

Prairie grasslands in eastern Montana are part of America's Great Plains region. This habitat type is generally found on high, rolling land, on some scattered hills, and in wide river valleys. Prairie grasslands are dominated by native bunchgrass and rhizomatous (having a horizontal stem that produces roots and shoots) grass species. This habitat experiences short, hot summers and long, cold winters. Precipitation ranges from 10 to 16 inches, with most of the precipitation occurring

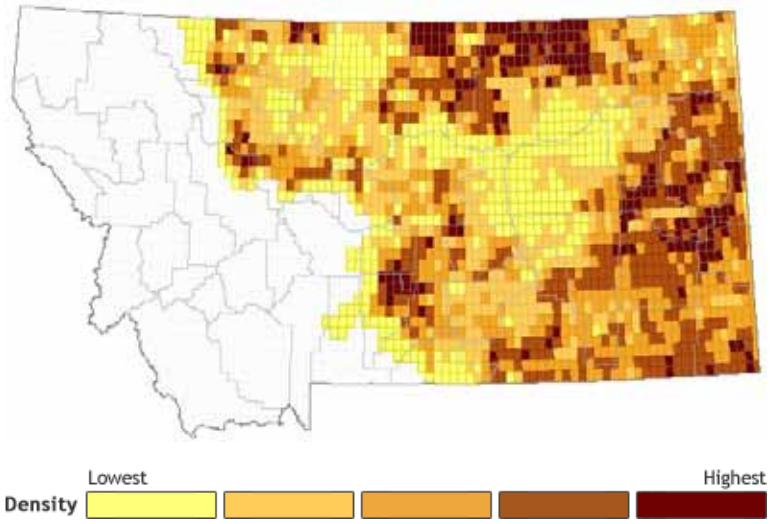

Figure C.5-1. *Map showing the general location of prairie grasslands identified in Montana (MT Field Guide 2012).*

during the late spring and early summer months. The growing season averages 115 days, ranging from 100 days on the Canadian border to 130 days on the Wyoming border. Wildlife associated with this habitat include approximately 69 species of mammals (18 are Species of Concern, which is 26 percent of the mammals associated with this habitat type); 121 species of birds (20 are Species of Concern, or 17 percent of the birds associated with this habitat type); and 16 species of reptiles and amphibians (7 are Species of Concern, or 44 percent of the reptiles and amphibians associated with this habitat type) (MT Field Guide 2012; MCFWCS 2005).

Prairie Grasslands Location in Montana

Native prairie grasslands occur on the plains of eastern Montana, where wetlands, sand prairie, lakes, and potholes are absent (see Figure C.5-1).

Intermountain/Foothill Grasslands

Intermountain/foothill grasslands are predominantly found in the western third of Montana. These grasslands are also referred to as Rocky Mountain Lower Montane, Foothill, and Valley Grasslands (MT Field Guide 2012).

Intermountain/Foothill Grasslands Description

Most of this native grassland type can be characterized by different combinations of six or seven major grass species (dominated by bunchgrasses and fescues), accompanied by a number of subordinate grass and forb species. Less than 10 percent of the habitat is covered by shrubs. Plant community composition is influenced primarily by total annual precipitation, yearly precipitation distribution, and soil characteristics. The climate of intermountain/foothills grasslands varies considerably throughout the state. It is semiarid, with precipitation averaging from 11.5 to 16.5 inches per year. Grassland vegetation is of moderate height in average precipitation years. Wildlife associated with this habitat include approximately 73 species of mammals (15 are Species of Concern, which is 21 percent of the mammals associated with this habitat type); 124 species of birds (17 are Species of Concern, or 14 percent of the birds associated with this habitat type); and 19 species of reptiles and amphibians (7 are Species of Concern, or 37 percent of the reptiles and amphibians associated with this habitat type) (MT Field Guide 2012; MCFWCS 2005; Casey 2000).

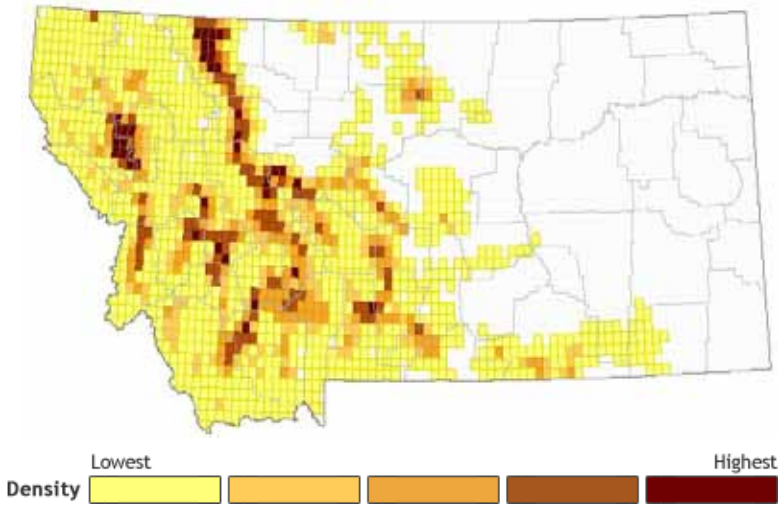

Figure C.5-2. *Map showing the general location of intermountain/foothill grasslands identified in Montana (MT Field Guide 2012).*

Intermountain/Foothill Grasslands Location in Montana

In western Montana, intermountain/foothill grasslands are found in the Flathead, Mission, Missoula, and Bitterroot valleys. This habitat is also found in the North Fork of the Flathead River in Glacier National Park and the Tobacco Plains north of Eureka in northwestern Montana. East of the Continental Divide, this system in found at lower elevations along the eastern edge of Glacier National Park, on the Blackfeet Indian Reservation, and south along the Rocky Mountain Front to west-central Montana. Pockets of this habitat are also found in eastern Montana island mountain ranges. These grasslands are generally found at elevations between 1,800 and 5,400 feet (MT Field Guide 2012) (see Figure C.5-2).

Native Shrub Habitats

Native shrub habitats include sagebrush shrub-steppe in eastern Montana and sagebrush shrublands located in southwestern Montana.

Sagebrush Shrub-steppe

Sagebrush shrub-steppe is the name given to the native sagebrush and grass associations found in eastern Montana. It is also referred to as shrub grassland and/or mixed shrub/grass associations (MCFWCS 2005). Additionally, this habitat type can be divided into types of shrub-steppe, including big sagebrush steppe and montane sagebrush steppe (MT Field Guide 2012).

Sagebrush Shrub-steppe Description

Sagebrush shrub-steppe is composed of sagebrush (5 to 20 percent shrub cover) interspersed with native grasses. The predominant sage species throughout sagebrush habitats in the state is basin big sage, although Wyoming big sage, mountain big sage, and black sage, or rubber rabbitbrush, can be co-dominant (MT Field Guide 2012; MCFWCS 2005; Casey 2000). Wildlife associated with this habitat include approximately 73 species of mammals (21 are Species of Concern, which is 29 percent of the mammals associated with this habitat type); 113 species of birds (12 are Species of Concern, or 11 percent of the birds associated with this habitat type); and 19 species of reptiles and amphibians (7 are Species of Concern, or 37 percent of the reptiles and amphibians associated with this habitat type) (MT Field Guide 2012; MCFWCS 2005; Casey 2000).

Sagebrush Shrub-steppe Location in Montana

In Montana, sagebrush shrub-steppe occurs throughout the central and southeastern part of the state. It is also found within

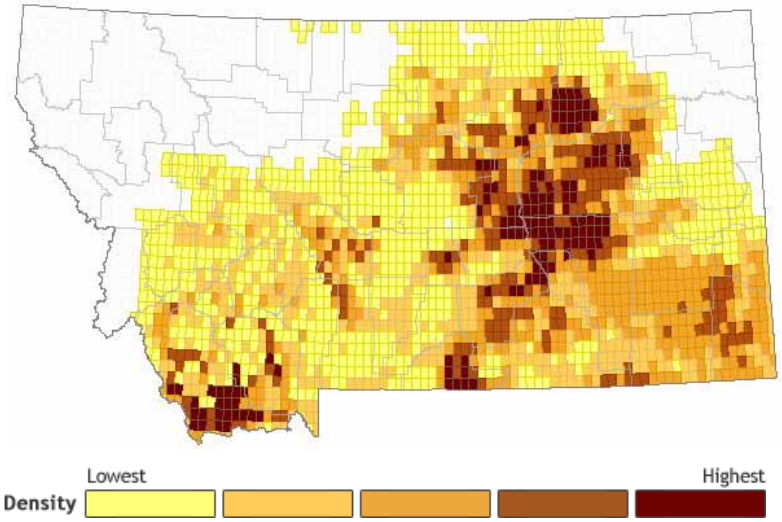

Figure C.5-3. *Map showing the general location of sagebrush shrub-steppe identified in Montana (MT Field Guide 2012).*

the island mountain ranges of the north-central and south-central portions of the state. It dominates the landscape of southwestern Montana, from valley bottoms to subalpine ridges, and is found as far north as Glacier National Park (MT Field Guide 2012) (see Figure C.5-3).

Sagebrush Shrublands

Sagebrush shrubland is the name given to sagebrush-dominated habitat. It is also referred to as sagebrush (MCFWCS 2005). Additionally, sagebrush shrubland can be divided into different types, including big sagebrush shrubland and low sagebrush shrubland (MT Field Guide 2012).

Sagebrush Shrublands Description

Sagebrush shrublands are composed of relatively pure sagebrush (20 to 80 percent sagebrush cover). The predominant sage species throughout sagebrush habitats in the state is basin big sage, although Wyoming big sage, mountain big sage, and black sage, or rubber rabbitbrush, can be co-dominant. It occurs on sites that are gently to moderately sloping, especially on dry, windswept hills and ridges. Elevation ranges from 3,750 feet in the Pryor Mountains and 4,000 feet in the Canyon Ferry area, up to 7,200 feet in southwestern Montana (MT Field Guide 2012; MCFWCS 2005; Casey 2000). Wildlife associated with this habitat include approximately 55 species of mammals (11 are Species of Concern, which is 20 percent of the mammals associated with this habitat type); 44 species of birds (8 are Species of Concern, or 18 percent of the birds associated with this habitat type); and 13 species of reptiles and amphibians (5 are Species of Concern, or 38 percent of the reptiles and amphibians associated with this habitat type) (MT Field Guide 2012; MCFWCS 2005; Casey 2000).

Sagebrush Shrubland Location in Montana

Most sagebrush shrubland in the state occurs in southwest and central Montana. At the northern end of its range, it occurs on the north flank of the Elkhorn Mountains near Helena. It is well represented in the Tobacco Root and Ruby Mountains, and occurs in other scattered locations in southwestern Montana. It is also found on the eastern side of the Beartooth range on outwash fans and lower slopes, and the southerly-facing side of the Pryor Mountains (MT Field Guide 2012) (see Figure C.5-4).

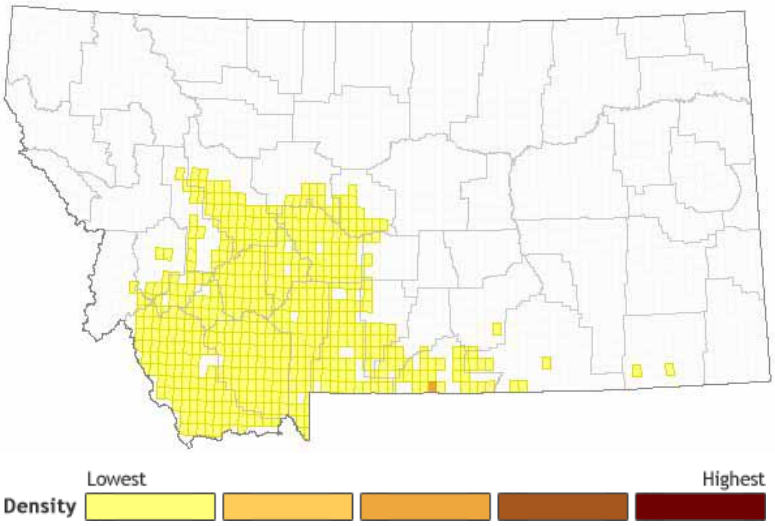

Figure C.5-4. Map showing the general location of sagebrush shrublands identified in Montana (MT Field Guide 2012).

Objectives of Recommended Design Standards

- Minimize the fragmentation and loss of native grassland and native shrub habitat patches.
- Maintain habitat patches important to wildlife and wildlife connectivity, and minimize the loss of large habitat patches.
- Maintain grassland and shrubland bird populations, especially Species of Concern.
- Reduce the spread of invasive, non-native species.

Conservation Status

Native grassland and native shrub habitat types are considered a Tier 1 ecosystem, or ecosystem in greatest need of conservation, in Montana's Comprehensive Fish and Wildlife Conservation Strategy (MCFWCS 2005). Many of the species associated with these habitats are vulnerable to human disturbance:

- Of the 219 species of mammals, birds, reptiles, and amphibians associated with native grasslands and native shrub habitats in Montana, 46 species (21 percent) are on the Montana Animal Species of Concern list (MT Field Guide 2012).
- Breeding grassland bird species are showing some of the steepest population declines of all landbirds in North America (Rich et al. 2004).
- Native grasslands provide habitat for Sprague's Pipit, currently listed as a Candidate Species under the Endangered Species Act (USFWS Federal Register 75: 56028–56050).
- Shrub-nesting landbird species comprise the largest number of Species of Continental Importance in the Intermountain West area of the United States and Canada. In Montana there are five (83 percent of total) Species of Continental Importance in shrub-steppe habitat (Rich et al. 2004).
- Native shrub habitats are occupied by the Greater Sage-Grouse, currently listed as a Candidate Species under the Endangered Species Act (USFWS Federal Register 75: 13959–14008).

Impacts from Development

Two top conservation concerns for native grasslands and native shrub habitats in Montana are (1) habitat loss, degradation, and fragmentation; and (2) invasive plant species. Contributing factors include various types of human activity, such as energy and residential developments, conversion of native habitat to agriculture, range management practices, unmanaged recreational uses, and loss of natural fire disturbance (MCFWCS 2005). Additionally:

- Risks to the sustainability of bird populations in North America include the shrinking of native prairies. Active conservation concerns include habitat loss and nest destruction due to expansion of farms, urban development, transportation, and other linear development (Wendt et al. 2006).
- Roads and infrastructure fragment native habitat patches. Recent research indicates that fragmentation caused by noise (e.g., road traffic) far exceeds the physical footprint of the source (e.g., the actual road) (Barber et al. 2009).

- Overhead power lines represent threats to avian and other small mammal species that depend upon native grasslands and native shrub habitats in two respects: (1) Corvids (crows, ravens, magpies, and jays) and raptors are drawn to overhead power lines as effective lookouts and hunting perches (Lammers and Collopy 2007); and (2) collisions between birds and overhead power lines can take a significant toll on grassland- and shrub-dependent avian species like prairie grouse (Wolfe et al. 2007).
- Invasion of non-native grasses and forbs is one of the greatest threats to grassland and shrubland bird habitat (Paige and Ritter 1999; Gillihan et al. 2001).
- Residential development often leads to increases in pets—and ". . . unrestrained pets can have a negative impact on nesting birds . . ." (Faaborg et al. 1995, p. 368).

Once native vegetation is removed or severely degraded, these habitats are difficult—if not impossible—to restore:

- ". . . [O]nce the prairie is destroyed, restoration requires several centuries" (Schramm 1990). (Sampson and Knopf 1994, p. 418).
- It may take more than 30 to 50 years to restore organic matter, soil carbon, and soil nitrogen of native prairies and grasses (Fuhlendorf et al. 2002).
- "Ecological restoration methods have not been developed specifically for the shortgrass prairie as they have for the tallgrass (true) prairie" (Askins et al. 2007, p. 19).
- "Most grassland-restoration experiments are conducted as research projects on small plots using expensive and labor-intensive methods, so it is unlikely that large restoration activities will be undertaken in the near future" (Askins et al. 2007, p. 30).
- When prairie species are replaced by introduced, non-native species (e.g., crested wheatgrass), these areas are difficult, if not impossible, to restore. Based on research in the northern Great Plains, grassland restoration ". . . faces two major obstacles: the contingency of native grass establishment on unpredictable precipitation, and competition from introduced species." Results indicate the establishment and survivorship of native species is related to summer precipitation, but existing introduced species are strong competitors, even with the application of herbicides (Bakker et al. 2003, p. 1).
- "For some species, there is no way to rectify their loss because a commercial seed source is not available and procedures for establishment are unknown. If severe degradation has occurred and natural recovery is unlikely, managers must develop restoration programs with the goal of establishing the most ecologically stable community that can exist on the site to protect the soils, maintain the desirable native species that remain, and prevent further degradation. Use of introduced species should not be excluded, but their inclusion requires a greater understanding of their growth form, persistence, effect on native species, and value as food or cover for wildlife" (Hoffman and Thomas 2007, p. 98).
- "Active restoration involves the physical removal of competitive species, preparation of seed beds, and seeding of desired species. A number of species are usually planted, and it is essential to understand the requirements for successful establishment for each species included in the seed mixture (Monsen 2005). Seeds of some species may need to

be broadcast while seeds of other species may need to be drilled into the soil at various depths. Lack of attention to all aspects of site preparation and seeding practices could result in widespread failures" (Hoffman and Thomas 2007, p. 98).

- "Rehabilitation and restoration techniques to transform lands currently dominated by invasive annual grasses into quality Greater Sage-Grouse habitat are largely unproven and experimental. Several components of the process are being investigated with varying success" (Pyke 2011, p. 543).
- "Availability and cost of native seed are major obstructions to use of native seeds in revegetation projects (McArthur 2004). The difficulties and vagaries of collecting, growing, and selling native seeds that have not been used historically within sagebrush ecosystems tends to raise prices and increase risks to both sellers and buyers (Bermant and Spackeen 1997; Currans et al. 1997; Roundy et al. 1997; Dunne 1999) relative to tested and released plants that are widely available" (Currans et al. 1997). (Pyke 2011, p. 544)
- "Success is not guaranteed when conducting Greater Sage-Grouse habitat restoration projects in semiarid environments. The only guarantee is that annual weather conditions can vary widely and these often dictate success of restoration projects" (Pyke 2011, p. 544).
- "Grasses and forbs may respond within 1 to 3 years if soils and seed sources permit recovery or restoration, but return to a shrub-dominated community often requires > 20–30 years, and landscape restoration may require centuries or longer (Hemstrom et al. 2002). Even longer periods may be required for sage-grouse to use recovered or restored landscapes" (Knick et al. 2011, p. 251).

Recommended Approach to Subdivision Design (where native grassland or native shrub habitat patch size is larger than 25 acres)

In designing the proposed subdivision, the subdivider is encouraged to follow the four steps outlined below. Local FWP wildlife biologists are encouraged, when contacted by the subdivider or the subdivider's representative, to make time for the consultation described in subsections b. and c. below.

a. Consult FWP's Crucial Areas Planning System (CAPS) and/or other publicly available sources of wildlife habitat information (e.g., information from the Montana Natural Heritage Program), for a preliminary indication of whether the property proposed for subdivision may be located in one or more native grassland or native shrub habitat patches.

b. Consult with the local FWP wildlife biologist, or other professionally trained biologist, to verify the preliminary assessment and confirm the approximate boundaries of any native grassland or native shrub habitat patches on or adjacent to the property proposed for development. If consulted, the FWP biologist should provide the subdivider with a written determination of whether or not native grassland or native shrub habitat patches are present on the property.

c. If the biologist determines that the property proposed for subdivision is located wholly or partially in one or more native grassland or native shrub habitat patches, consult

further with the biologist for site-specific information and recommendations on minimizing the impacts of the subdivision on the native vegetation and species likely to be using the habitat. FWP biologist recommendations may include suggestions for avoiding or strictly limiting the placement of subdivision design features in the native habitat patch. In offering these recommendations, the FWP biologist should take into account the wildlife and habitat data compiled by the subdivider, any field reviews completed by other professionally trained biologists, FWP's own wildlife and habitat data, and any other applicable biological information.

d. Incorporate the biologist's recommendations into the design of the proposed subdivision.

Recommended Standards (where native grassland or native shrub habitat patch size is larger than 25 acres)

Whether or not the subdivision design approach recommended above is completed, the following standards pertain to any subdivision development proposed on property that contains or lies adjacent to one or more native grassland or native shrub habitat patches:

a. If subdivision design features (e.g., buildings, roads, utilities) are located inside habitat patches, place them adjacent to, or as close as possible to, existing development located outside of the habitat patches. Cluster the subdivision design features on as small a footprint as possible (see Figure C.5-5).

b. Locate areas of proposed open space immediately adjacent to existing native vegetation or open space on adjacent lands, in order to maintain the functional connection with other open space and native grassland and native shrub habitat patches on public and private lands.

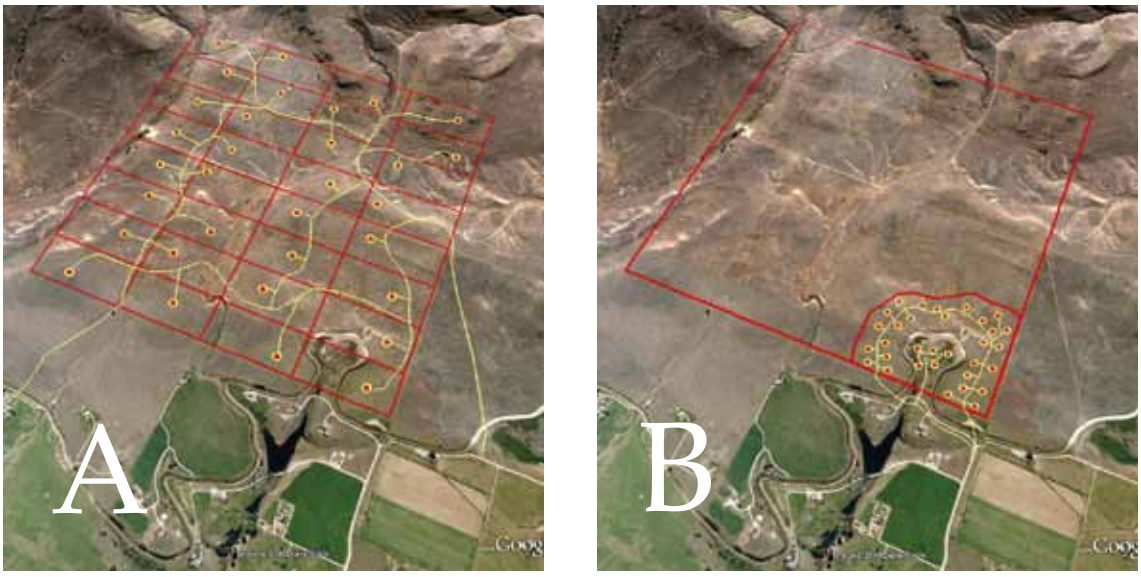

Figure C.5-5. *Examples of dispersed and clustered development on native grasslands.*

Example 'A' depicts development of thirty-two 20-acre lots spread across 640 acres of native grasslands. Example 'B' illustrates a "clustered" design of the same thirty-two houses on 2-acre lots on 10 percent of the property, or 64 acres, situated in a corner near existing development. Clustering homes as shown in example B obviously impacts native grasslands much less than the dispersed development found in example A.

c. Minimize the extent of subdivision roads needed to provide access to all areas proposed for development.
d. Install new utility lines underground.
e. Revegetate with native seed *after* road construction and utility installation.
f. Develop a weed control plan, approved by the local weed district, for the entire property proposed for subdivision.

Additional Guidance for Minimizing Fragmentation and Maintaining Connectivity

The scientific literature provides additional guidance for addressing the first two design objectives listed on page C.5-66 above. Numerical thresholds based on this science are offered and illustrated below, as an additional development design option for biologists and subdivision designers to consider.

Table C.5-1 below would only apply to native grassland or native shrub habitat patches greater than 25 acres in size. The table identifies how much of a native grassland or native shrub habitat patch could be developed and still minimize habitat fragmentation for wildlife, based upon its existing size and *regardless* of land ownership.

Table C.5-1. *Recommended development limits for native grassland or native shrub habitat patches located within a proposed subdivision*

Total Native Grassland or Native Shrub Habitat Patch Size	Recommended Limits to Habitat Patch Development within a Proposed Subdivision	Subdivider is Advised to Consult FWP for Recommendations on Extent and Location of Proposed Development.
> 25 to 100 acres	A maximum of 5% of the portion of the habitat patch located within the proposed subdivision site could be developed, and at least 25 acres of the habitat patch should remain undeveloped.	No
> 100 to 1,000 acres	A maximum of 10% of the portion of the habitat patch located within the proposed subdivision site could be developed.	Yes
> 1,000 acres	A maximum of 20% of the portion of the habitat patch located within the proposed subdivision site could be developed.	Yes

Substantial Evidence for Native Grassland and Native Shrub Habitat Recommendations

In order to more easily describe the rationale and scientific evidence for the native grassland and native shrub habitat recommended standards, the standards have been divided into six provisions. Each provision is stated below, followed by the rationale and substantial evidence supporting that provision, including pertinent scientific studies and professional biologist opinions.

Provision 1. Recommended Approach to Subdivision Design. In designing the proposed subdivision, the subdivider is encouraged to follow the four steps outlined below:

(a) Consult FWP's Crucial Areas Planning System (CAPS) and/or other publicly available sources of wildlife habitat information (e.g., information from the Montana Natural Heritage Program), for a preliminary indication of whether the property proposed for subdivision may be located in one or more native grassland or native shrub habitat patches.

(b) Consult with the local FWP wildlife biologist, or other professionally trained biologist, to verify the preliminary assessment and confirm the approximate boundaries of any native grassland or native shrub habitat patches on or adjacent to the property proposed for development. If consulted, the FWP biologist should provide the subdivider with a written determination of whether or not native grasslands or native shrub habitat patches are present on the property.

(c) If the biologist determines that the property proposed for subdivision is located wholly or partially in one or more native grassland or native shrub habitat patches, consult further with the biologist for site-specific information and recommendations on minimizing the impacts of the subdivision on the native vegetation and species likely to be using the habitat. FWP biologist recommendations may include suggestions for avoiding or strictly limiting the placement of subdivision design features in the native habitat patch. In offering these recommendations, the FWP biologist should take into account the wildlife and habitat data compiled by the subdivider, any field reviews completed by other professionally trained biologists, FWP's own wildlife and habitat data, and any other applicable biological information.

(d) Incorporate the biologist's recommendations into the design of the proposed subdivision.

Substantial Evidence for Provision 1

- CAPS is an easy-to-use informational and early planning tool that subdividers can use to identify important habitats in a given area. CAPS helps developers begin early to consider the potential effects of a proposed subdivision on wildlife and wildlife habitat. This system is free and available to any person with Internet access. CAPS will provide useful, initial information about whether a property proposed for subdivision might be located in native grasslands or native shrub habitats. CAPS can also give developers a general idea about the impacts a subdivision might have on identified habitats and species. Additional data sources of value during the early stage of subdivision site planning and design include FWP's individual GIS data layers, the *Montana Animal Field Guide,* and the *Ecological Systems Field Guide* (see Appendix A) (FWP website 2012).

- However, "CAPS is not a substitute for a site-specific evaluation of fish, wildlife, and recreational resources. There is still no substitute for consulting with local FWP biologists to gain a better understanding of conditions and management challenges in a particular area of the state—but CAPS will help you start smart." A FWP biologist with knowledge of a property is the best authority for determining whether a property proposed for subdivision is located in native grasslands or native shrub habitats. FWP and other professionally trained biologists may also be familiar with whether or not a given property functions as habitat that supports one or more native grassland or native shrub species, especially Species of Concern (FWP website 2012).

- Grassland and shrub habitats are difficult—if not impossible—to restore. Therefore, it is important to carefully plan before impacts are made to these habitat types (e.g., Askins et al. 2007; Bakker et al. 2003; Fuhlendorf et al. 2002; Hoffman and Thomas 2007; Pyke 2011; Knick et al. 2011; Sampson and Knopf 1994).

- "Grasses and forbs may respond within 1 to 3 years if soils and seed sources permit recovery or restoration, but return to a shrub-dominated community often requires > 20–30 years, and landscape restoration may require centuries or longer (Hemstrom et al. 2002). Even longer periods may be required for sage-grouse to use recovered or restored landscapes." (Knick et al. 2011, p. 251)

- "Some area-sensitive obligate grassland species (and also some habitat specialists) require large unbroken blocks of grassland habitat with little or no interspersion with other habitat types. For this reason, it is crucial to consider landowner objectives, local landscape features and management potential, and area-wide population goals of target grassland species in the area when planning management actions for grassland birds. Consultation with state and Federal wildlife agencies and review of established grassland bird priorities for the region (e.g., Partners in Flight Bird Conservation Plans—see **www.partnersinflight.org**) can assist in this process" (Wildlife Habitat Management Institute 1999, p. 4).

- Native grasslands and native shrublands are two of Montana's habitats in greatest need of conservation. One of the top two conservation concerns for these habitats is habitat loss, degradation, and fragmentation. Contributing factors include various types of human activity, such as energy and residential developments, conversion of native habitat to agriculture, range management practices, unmanaged recreational uses, and loss of natural fire disturbance (MCFWCS 2005).

- "Native grassland and shrub habitats are relatively rare on the landscape in Montana, as much of the land has already been converted to agriculture or development. Thus, the conservation of remaining habitats is critical to the persistence of the bird species that depend on them. Some habitat patches are more important than others; hence, our goal is to provide guidelines for conserving critical habitat patches and encouraging development elsewhere. In general, we encourage development in areas that are already dominated by nonnative vegetation" (Wightman 2012, p. 3).

- ". . . Odell et al. (2003) discuss the benefits of clustering, pointing out that clustered developments decrease fragmentation and perforation of habitats due to roads and houses, leaving the remainder of the landscape in a condition more suitable for wildlife sensitive to elevated human densities. For example, if houses on a large parcel of land were clustered on a small portion of its acreage with the remaining acres left undisturbed, wildlife communities would likely be characterized by a higher proportion of human sensitive species (Odell et al. 2003). . . . The case for clustering is made by numerous researchers (Arendt 1997; Theobald et al. 1997; Maestas et al. 2001; Odell and Knight 2001; Glennon 2002; Hansen et al. 2002; Odell et al. 2003; Glennon and Porter 2005)." (Glennon and Kretser 2005, pp. 29–30)

Provision 2. Prevent habitat patch fragmentation by placing proposed subdivision design features (e.g., buildings, roads, utilities) adjacent to, or as close as possible to, existing development located outside of the habitat patches. Cluster the subdivision design features on as small a footprint as possible. Also, locate areas of open space immediately adjacent to existing native vegetation or open space on adjacent lands, in order to maintain the functional connection with other open space and native grassland and native shrub habitat patches on public and private lands.

Substantial Evidence for Provision 2

- ". . . [H]abitat fragmentation occurs when a large, fairly continuous tract of a vegetation type is converted to other vegetation types or land uses such that only scattered fragments of the original vegetation type remain." In addition to direct habitat loss, fragmentation can increase the amount of edge habitat, which can lead to increased nest predation, parasitism, and interspecific competition [competition between individuals of two or more *different* species for the same resource], and reduced pairing and nest success (Faaborg et al. 1995, p. 358).

- Habitat fragmentation results in quantitative and qualitative loss of habitat for native species (Temple and Wilcox 1986).

- "The composition and spatial configuration of a landscape can independently or in combination affect ecological processes including species' distributions and biotic interactions (Dunning et al. 1992)." (Freemark et al. 1995, p. 384)

- Research has identified at least 22 bird species associated with grassland or shrub habitats that are sensitive to patch size or fragmentation (Freemark et al. 1995).

- ". . . [D]ensity and richness of the grassland bird community are associated with landscape features. Studies elsewhere have found that the context in which the patch is situated affects the density of birds found in the patch" (Sample et al. 2003, p. 368).

- "The human-induced mosaic is characterized also by a strong contrast between patches and by the appearance of long edges" (Farina 2003, p. 183).

- Roads and infrastructure fragment native habitat patches. Research indicates that fragmentation caused by noise (e.g., road traffic) far exceeds the physical footprint of the source (e.g., the actual road) (Barber et al. 2009).

Provision 3. Minimize the extent of subdivision roads needed to provide access to all areas proposed for development.

Substantial Evidence for Provision 3

- Roads and infrastructure fragment native habitat patches. Research indicates that fragmentation caused by noise (e.g., road traffic) far exceeds the physical footprint of the source (e.g., the actual road) (Barber et al. 2009).

- "Roads and trails are implicated in dispersal of exotic species (Larson et al. 2001). Roads are also associated with direct mortality of birds (e.g., 20–37 percent of Burrowing Owl mortality; Haug et al. 1993) as well as changes in habitat and ecological function (Forman 2000; Trombulak and Frissell 2000). Songbird numbers were 20–50 percent lower within 100 m [328 feet] of gravel roads in Saskatchewan (Sutter et al. 2000) and Wyoming (Ingelfinger 2001). Assuming a similar zone of effect, Forman (2000) estimated that 16.7 percent of rural areas in the United States are influenced by roads. The zone of effect may be larger, because grassland songbirds continued to increase with distance from roads out to 2 km [1.2 miles] (Koper and Schmiegelow 2006b)." (Askins et al. 2007, p. 22)

- "Roads are a source of habitat fragmentation as well as a source for animal mortality and the movement of exotic plant species, among other impacts (Trombulak and Frissell 2000). Birds have been found to avoid roads with heavy traffic volumes (Reijnen et al. 1996) as well as low traffic volumes along dirt roads (Ingelfinger and Anderson 2004)" (Cariveau 2007, p. 1).

- "The connecting infrastructure of roads, motorized trails, railways, power lines, and communications corridors fragment or remove sagebrush land cover (Leu et al., this volume, chapter 13). The ecological impact of roads and motorized trails include: (1) increased mortality of wildlife from collisions with vehicles, (2) modification of animal behavior because of habitat changes or noise disturbance, (3) alteration of physical environment, (4) alteration of chemical environment through leaching or erosion, (5) spread of exotic and invasive plant and wildlife, and (6) increased habitat alteration and use by humans (Forman and Alexander 1998; Forman 2000; Trombulak and Frissell 2000; Ouren et al. 2007). Unpaved roads fragment sagebrush landscapes as well as provide disturbed surfaces that facilitate spread of invasive plant species (Belcher and Wilson 1989; Gelbard and Belnap 2003)." (Knick et al. 2011, p. 219)

- "Over 8,400,000 people live within 3 miles of sagebrush. As infrastructure expands to support population growth, sagebrush is fragmented into small, isolated patches, ultimately making the landscape unsuitable for sage-grouse. Ninety-five percent of the sagebrush within the sage-grouse range is within 1.5 miles of a road. Roads can influence predator movements, introduce invasive species, increase wildfire potential

from human activities, and exacerbate other factors that may adversely affect sage-grouse" (USGS 2009, p. 3).

Provision 4. Install new utility lines underground.

Substantial Evidence for Provision 4

- Overhead power lines represent threats to avian and other small mammal species that depend upon native grasslands and native shrub habitats in two respects: (1) Corvids (crows, ravens, jays, and magpies) and raptors are drawn to overhead power lines as effective lookouts and hunting perches (Lammers and Collopy 2007); and (2) collisions between birds and overhead power lines can take a significant toll on grassland- and shrub-dependent avian species like prairie grouse (Wolfe et al. 2007).

- "Power line poles along transmission corridors provide nest and perching opportunities for Common Ravens (*Corvus corax*), American Crows (*C. americanus*), and raptors (Reinert 1984; Knight and Kawashima 1993; Steenhof et al. 1993; Lammers and Collopy 2007). Ravens are primary predators on sage-grouse and other prairie grouse nests (Manzer and Hannon 2005; Coates et al. 2008) and can travel > 10 km [6.2 miles] from these locations (Boarman and Heinrich 1999). Collisions with power lines, in addition to increased predation risk, were a primary source of mortality for lowland populations of sage-grouse in Idaho (Beck et al. 2006)." (Knick et al. 2011, p. 245)

- "F. Hall (2004 pers. comm.) in a Lassen County, CA, study on Greater Sage-Grouse has recently documented significant impacts from overhead power transmission and communication distribution lines to this species out to 3.7 mi (6 km)" (Manville 2004, p. 10).

- "The Service [USFWS] asserts that by avoiding or minimizing construction of wind facilities [and their associated infrastructure, which includes power lines and roads] in native prairie grasslands and native sage-steppe habitats, grassland- and sage-dependent native songbird species would be protected and habitat fragmentation would be avoided" (Manville 2004, p. 13).

Provision 5. Revegetate with native seed *after* road construction and utility installation. Also, develop a weed control plan, approved by the local weed district, for the entire property proposed for subdivision.

Substantial Evidence for Provision 5

- One of the top two conservation concerns for native grasslands and native shrub habitats in Montana is invasive plant species. Contributing factors include various types of human activity, such as energy and residential developments, conversion of native habitat to agriculture, range management practices, unmanaged recreational uses, and loss of natural fire disturbance (MCFWCS 2005).

- Invasion of non-native grasses and forbs is one of the greatest threats to grassland and shrubland bird habitat (Paige and Ritter 1999; Gillihan et al. 2001).

- "Grassland birds disappear or decline once the native cover is removed (Johnson and Schwartz 1993a, b; McMaster and Davis 2000) or replaced with hay (Dale et al. 1997; McMaster et al. 2005)." (Askins et al. 2007, p. 22)

- "Invasion by exotic plants (Wilson and Belcher 1989; Robbins and Dale 1999; Scheiman et al. 2003; Grant et al. 2004) reduces avian occupancy of grassland." (Askins et al. 2007, p. 22)

- To avoid and mitigate the impacts of wind energy projects on wildlife, it is recommended that development occur on already disturbed lands and use existing transmission corridors and roads. The temporary impacts of construction (e.g., road and utility installation) on grass, CRP, or shrub-steppe habitats can be mitigated by implementing a restoration plan for the impacted area. A restoration plan should include reseeding with appropriate vegetation and noxious weed control (Washington Dept. of Fish and Wildlife 2009).

Provision 6: Additional guidance is provided for minimizing fragmentation and maintaining connectivity of native grassland and native shrub habitat patches. This guidance spells out recommended limits on development for habitat patches in three categories: (1) more than 25 acres to 100 acres (develop no more than 5 percent *and* keep at least 25 acres of the habitat patch undeveloped); (2) more than 100 acres to 1,000 acres (develop no more than 10 percent); and (3) more than 1,000 acres (develop no more than 20 percent). It should be noted that under this additional guidance, habitat patch size is determined by the existing size of the habitat patch (not the historic size). In addition, the habitat patch can cross land ownership lines because it is based on where specific habitat types are located and not on who owns a parcel of land.

Substantial Evidence for Provision 6

- Many species of grassland songbirds require at least 25 acres of native grassland habitat to occupy a patch. The rate of bird incidence increases exponentially as patch size increases to at least 100 acres for some species and more than 1,000 acres for other species (Askins et al. 2007).

- For grassland breeding birds, species richness is maximized when patches are large (more than 50 hectare or more than 100 acres) and shaped so that they provide abundant interior areas, free from the impacts of edges (Helzer and Jelinski 1999).

- Research has documented that grassland songbird abundance decreases severely when the sum of all urban activities was more than 5 percent of 100 acres (Haire et al. 2000).

- Shrub-steppe obligate songbird species tend to require larger patches (e.g., more than 320 acres for Sage Sparrows) of native shrublands (Paige and Ritter 1999).

- Raptors that use grassland and shrub habitats typically require at least 750 to 5,000 acres of foraging habitat during the nesting season (Casey 2000; Larsen et al. 2004).

- Long-billed Curlews occupy home ranges approximately 35 acres in size (Casey 2000).

- Sprague's Pipits require a minimum of 358 acres (average) of native grassland habitat patches (Davis 2004).

- "In general, large patches better sustain wildlife populations and ecosystem functions over time than small patches" (Environmental Law Institute 2003, p. 7).

- Risks to the sustainability of bird populations in North America include the shrinking of native prairies. Active conservation concerns include habitat loss and nest destruction due to expansion of farms, urban development, transportation, and other linear development (Wendt et al. 2006).

- One of the top two conservation concerns for native grasslands and native shrub habitats in Montana is habitat loss, degradation, and fragmentation. Contributing factors include various types of human activity, such as energy and residential developments, conversion of native habitat to agriculture, range management practices, unmanaged recreational uses, and loss of natural fire disturbance (MCFWCS 2005).

- "Patches smaller than 25 acres tend to provide little grassland habitat for most grassland [bird] species. Research has also documented that grassland bird abundance decreases significantly when the sum of all urban activity is 5 percent of 100 acres (Haire et al. 2000), and urbanization shifts the bird community toward more nonnative species and fewer native species (Marzluff 2001)." (Wightman 2012, p. 3)

- Shrub-associated birds tend to have larger home ranges than grassland birds, suggesting a similar pattern of increased densities at larger patch sizes" (Wightman 2012, p. 3).

- "Limiting subdivision development to 5 percent or less of 25- to 100-acre patches in grassland and shrub habitat is important for maintaining bird populations. Patches of this size are critical for many species and cannot withstand much fragmentation or urbanization" (Wightman 2012, p. 3).

- "[I]t is reasonable to assume that birds can withstand development of somewhat greater percentages as patch size increases, as long as fragmentation is minimized by clustering development to one side of the patch. Limiting subdivision development to 10 percent of 100- to 1,000-acre patches would allow for some development while maintaining larger landscapes for avian species with larger patch size requirements (e.g., Sprague's Pipits, Long-billed Curlew)" (Wightman 2012, p. 4).

- "Some birds have relatively large patch requirements (750–200,000 acres; e.g., raptors, grouse). It is imperative that some large patches are maintained across the landscape for these species. Allowing development on 20 percent of patches greater than 1,000 acres in size would allow for some development while retaining relatively large patches for wildlife" (Wightman 2012, p. 4).

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